JAPANESE [JP,11-312820,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] It is the solar cell module characterized by having two or more connections which two or more solar batteries each other electrically connected with a surface member which has translucency, and a rear-face member by connection tab between **s are the solar cell modules which come to carry out the closure, and said connection tab of each other is separated, and form a connection side with said solar battery.
[Claim 2] Said connection tab is a solar cell module according to claim 1 characterized by having two or more connections which form a connection side with said solar battery, and the connection section which estranges from a connection side with said solar battery, and connects said two or more connections mutually.
[Claim 3] The manufacture method of the solar cell module a solar cell module is characterized by to use a sheet from which it is the manufacture method of two or more solar batteries and a sealing agent sheet which were electrically connected by a rear-face member, a sealing agent sheet, and connection tab, and a solar cell module which closes two or more of said solar batteries between said surface and a rear-face member when a surface member carries out heating compression of the layered product which comes to carry out a laminating, and a portion corresponding to said connection tab was removed as said sealing agent sheet.
[Claim 4] A rear-face member, a sealing agent sheet, two or more solar batteries each other electrically connected by connection tab, It is the manufacture method of a sealing agent sheet and a solar cell module which closes said two or more solar batteries between said surface and a rear-face member when a surface member carries out heating compression of the layered product which comes to carry out a laminating. As said sealing agent sheet A manufacture method of a solar cell module characterized by using a sheet with which thickness of a portion corresponding to said connection tab was considered as closing in rather than other portions.
[Claim 5] A manufacture method of a solar cell module according to claim 3 or 4 characterized by connecting said connection tab to said solar battery in two or more connection sides where it dissociated mutually.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the technology which raises the yield of a solar cell module.
[0002]
[Description of the Prior Art] The solar battery is expected as a new energy source from the light from the sun which is a clean inexhaustible energy source being convertible for the direct electrical and electric equipment.
[0003] In using this solar battery as a power supply of a house or a building, the output per solar battery is used as a solar cell module which raised the output even to several 100 W by connecting two or more solar batteries usually to a serial or juxtaposition electrically from a small thing with about several [at most] W.
[0004] The closure of drawing 3 is carried out with the sealing agent 5 which has translucency, such as EVA between the surface member 3 which is electrically connected by the connection tab 2 with which it is structure section drawing of this conventional solar cell module, for example, two or more solar batteries 1 which consist of single crystal silicon which has pn junction inside consist of electric conduction material, such as copper foil, mutually, and has translucency like glass and translucency plastics, and the rear-face member 4 which consists of an aluminium foil sandwiches mold fluoride [vinyl] film.
[0005] By the way, this solar cell module is usually manufactured through the following production processes.
[0006] Drawing 4 is drawing showing an example of the solar battery used for the usual solar cell module, this drawing (A) is cross-section structural drawing, and (B) is a plan.
[0007] In this drawing, 11 is the substrate of the single crystal silicon which has the conductivity of p mold. And 12 [n-layer] is formed in the surface of a substrate 11 by carrying out thermal diffusion of the n mold impurity even at a depth of about 5 micrometers, and the tandem-type-like collector 13 is formed on this n layer 12. Moreover, said collector 13 and the rear-face electrode 14 which makes a pair are formed in the rear face of a substrate 11.
[0008] Moreover, with reference to this drawing (B), the collector 13 consists of finger section 13A for collecting the optical generation carriers of the electron and electron hole generated by the incidence of light within the substrate 11, and bus bar section 13B for collecting the carrier collected by finger section 13A.
[0009] Here, since a collector 13 serves as a cause which the light which carries out incidence to a solar battery is interrupted [cause], and decreases the effective area of a solar battery, as for the area, it is desirable [a collector] to make it as small as possible. For this reason, width of face of finger section 13A is set to about 100 micrometers, and the gap between each finger section 13A is usually set to about 2mm. Moreover, since bus bar section 13B collects the carrier collected by each finger section 13A, it needs to decrease a resistance component to some extent, and for this reason, width of face is set up more broadly than about 1.5mm and finger section 13A. And the collector 13 which has these finger section 13A and bus bar section 13B is formed in the thickness of about 40 micrometers by screen printing.
[0010] Subsequently, drawing 5 is drawing showing the condition of having connected the solar batteries of this structure with the connection tab 2, this drawing (A) is a cross section and this drawing (B) is a plan. In addition, in this drawing, as shown in this drawing which attaches the same sign, the adjoining solar batteries 1 and 1 are that bus bar section 13B in the collector 13 of one solar battery 1 and the rear-face electrode 14 of the solar battery 1 of another side are connected by the connection tab 2, and each other are electrically connected to the portion which has drawing 3 and the same configuration as 4.
[0011] As the above-mentioned connection tab 2, the thing to which solder was made to adhere is usually used for both sides of a thin tabular metal with a thickness [, such as copper foil,] of about 100 micrometers. Moreover, if it considers as narrow-width about width of face a little than the width of face of bus bar section 13B, and it is when the width of face of bus bar section 13B is about 1.5mm as mentioned above, width of face of the connection tab 2 is set to about 1mm. And where this connection tab 2 is superimposed on bus bar section 13B in one solar battery 1, it heats with hot blast or lamp heating more than in the melting temperature of about 190 degrees C of solder, for example, temperature, melting of the solder is carried out, and the connection tab 2 and bus bar section 13B are connected.
[0012] Moreover, to the rear-face electrode 14, similarly, heating fusion of the solder is carried out in the condition of having made the connection tab 2 superimposing on the rear-face electrode 14, and both are connected.
[0013] And let two or more solar batteries each other electrically connected by the connection tab 2

manufactured according to the above production process be solar cell modules with a heating sticking-by-pressure method using the lamination equipment shown in drawing 6 .
[0014] In drawing 6 , a case when the hot platen having a heater with which 21 was prepared in the bottom case and 22 was prepared in the bottom case 21, and 23 are attached in the bottom case 21 airtightly and free [attachment and detachment] through O ring 24, and 25 are the diaphrams formed in the top case 23, and the space of a batch formed between the bottom case 21 and the top case 23 is in the bottom room 26 and the top room 27.
[0015] Moreover, an end is wide opened by atmospheric air the room pipe after the bottom room pipe which the vacuum pump for evacuation in 28 and 29 were connected to the vacuum pump 28, and was open for free passage in the bottom room 26, and 30 were connected to the vacuum pump 28 through the vacuum valve 31 and it is open for free passage in the top room 27, and 32, and the other end is the atmospheric-air pipe which was open for free passage in the top room 27 through the breather valve 33.
[0016] And on a hot platen 22, a rear-face member, the sealing agent sheet which consists of EVA, two or more solar batteries connected by the connection tab, the sealing agent sheet which consists of EVA, and a surface member lay the layered product 20 which comes to carry out a laminating one by one, and close the breather valve 33 of anchoring and the atmospheric-air pipe 32 for the top case 23 airtightly through O ring 24 to the bottom case 21.
[0017] Subsequently, an aperture and a vacuum pump 28 are operated in the vacuum valve 31 of the top room pipe 30, and the top room 27 and the bottom room 26 are exhausted to a vacua through the top room pipe 30 and the bottom room pipe 29.
[0018] And while energizing at the heater of a hot platen 22, heating a layered product 20 even in temperature of about 150 degrees C and closing the vacuum valve 31 of the top room pipe 30 in this condition, the breather valve 33 of the atmospheric pressure pipe 32 is opened, and the inside of the top room 27 is made into atmospheric pressure. Then, diaphram 25 presses a deflection and a layered product 20 in the state of heating by the differential pressure of the top [this] room 27 and the bottom room 26, the sealing agent sheet of two sheets in a layered product 20 will be in a softening condition, and the solar cell module of the configuration of drawing 3 which comes to close two or more solar batteries between a surface member and a rear-face member will be manufactured.
[0019]
[Problem(s) to be Solved by the Invention] By the way, although the silicon substrate which usually has the thickness of 400 micrometers - about 500 micrometers was used if it was in the solar battery using the above-mentioned conventional crystal silicon substrate, thickness of a silicon substrate is made thin from the request of cost reduction in recent years, and using the silicon substrate which has about 150-300 micrometers or the thickness not more than it is examined.
[0020] However, if it was when a silicon substrate with thin thickness was used for ** et al. and Mr. **, when connecting solar batteries with a connection tab, the technical problem that it was easy to damage a substrate occurred. That is, since a connection tab consists of metals, such as copper foil, the coefficient of thermal expansion is larger than a silicon substrate. For this reason, by the conventional method of heating at about 190 degrees C and connecting a connection tab, in case temperature returns to ordinary temperature, stress joins a substrate according to the difference of the coefficient of thermal expansion of a connection tab and a substrate. And since the resistance of the substrate to this stress falls so that the thickness of a substrate becomes thin, if a silicon substrate with thickness thinner than before is used, it wil be easy to damage it.
[0021] Furthermore, if thickness of a substrate is set to about 150-300 micrometers, the thickness of a connection tab will serve as thickness of a substrate, and an abbreviation EQC. For this reason, when manufacturing a solar cell module by heating compression, a connection tab will be locally joined by thrust, but since the thickness of a substrate was thin, the technical problem that it was easy to damage a substrate rather than before occurred.
[0022] Therefore, when this technical problem is solved and the thin crystal silicon substrate of thickness is used rather than usual, even if there is this invention, it aims at offering a solar cell module with a sufficient yield.
[0023]
[Means for Solving the Problem] In order to solve this technical problem, this invention solar cell module is a solar cell module with which it comes to carry out the closure of two or more solar batteries each other electrically connected with a surface member which has translucency, and a rear-face member by connection tab between **s, and said connection tab is characterized by having two or more connections which are separated mutually and form a connection side with said solar battery.
[0024] Furthermore, two or more connections in which said connection tab forms a connection side with said solar battery, Moreover it is characterized by having the connection section which estranges from a connection side with said solar battery, and connects said two or more connections mutually, this invention solar cell module a manufacture method A rear-face member, a sealing agent sheet, two or more solar batteries each other electrically connected by connection tab, It is the manufacture method of a sealing agent sheet and a solar cell module which closes said two or more solar batteries between said surface and a rear-face member when a surface member carries out heating compression of the layered product which comes to carry out a laminating. As said sealing agent sheet It is characterized by using a sheet from which a portion corresponding to said connection tab was removed.
[0025] Or a rear-face member, a sealing agent sheet, two or more solar batteries each other electrically connected by connection tab, It is the manufacture method of a sealing agent sheet and a solar cell module

which closes said two or more solar batteries between said surface and a rear-face member when a surface member carries out heating compression of the layered product which comes to carry out a laminating. As said sealing agent sheet Thickness of a portion corresponding to said connection tab is characterized by using a sheet considered as closing in rather than other portions.
[0026] Furthermore, it is characterized by connecting said connection tab to said solar battery in two or more connection sides where it dissociated mutually.
[0027]
[Embodiment of the Invention] (Gestalt of the 1st operation) With reference to drawing 1 , it explains about the solar cell module concerning the 1st operation gestalt of this invention.
[0028] Drawing 1 is the adjoining solar battery 1 and the cross section showing the condition of having connected between one with the connection tab 2. In addition, the same sign is attached about the same portion as the configuration shown in drawing 5 in this drawing.
[0029] A point different conventionally which was shown in drawing 5 in this drawing from structure is in the point considered as the configuration equipped with two or more connection 2A which has a flat side for like before] dissociating not tabular but mutually and forming a connection side with a solar battery 1 on bus bar section 13B and the rear-face electrode 14 for the connection tab 2. And connection 2A of these plurality is mutually connected by rising from a connection side with a solar battery by connection section 2B estranged from the connection side with a solar battery.
[0030] That is, according to the gestalt of this operation, it will connect with said solar battery 1 in two or more connection sides which are formed of connection 2A of the connection tab 2 and which were separated mutually. Therefore, according to this configuration, connection between a connection tab and a solar battery will be made in respect of two or more connection by which area was made to decrease more sharply than before, and can control damage on the substrate 1 which is produced at the time of connection of the connection tab 2 for this reason.
[0031] Namely, although both will expand thermally since it is heated by about 190 degrees C as mentioned above in case a solar battery 1 and the connection tab 2 are connected, the degree of expansion of the direction of the large connection tab 2 of coefficient of thermal expansion is large in this case. And also in case the solar battery 1 and the connection tab 2 which were connected in the condition of having expanded return to ordinary temperature, the amount of contraction becomes [the direction of the large connection tab 2 of coefficient of thermal expansion] large. For this reason, although a solar battery 1 will be joined by stress, according to this invention, the part which forms the connection side of the connection tab 2 and a solar battery 1 is only the above-mentioned connection 2A, and further two or more connection sides have composition mutually separated by connection section 2B. Therefore, since connection between each connection tab 2 and a solar battery 1 will be made in respect of two or more connection which has the 1/several about conventional area, the stress which joins a solar battery 1 conventionally is reduced, and it becomes possible [controlling failure of a solar battery 1].
(Example 1) Next, it explains per example of this invention.
[0032] In this example, p mold single crystal silicon with a thickness of about 150 micrometers was used with the 10cmx10cm size as a substrate 11 of a solar battery 1. And this substrate 1 was heated even at about 700 degrees C in the POCl3 ambient atmosphere, thermal diffusion of the P (Lynn) which is n mold impurity was carried out even to the depth of about 5 micrometers of surfaces of a substrate 1, and n layers were set to 12.
[0033] Subsequently, on the above-mentioned n layer 12, Ag paste was used, the collector 13 was formed with screen printing, aluminum paste was further used all over the rear face of a substrate 1, and the rear-face electrode 14 was formed. In addition, you may make it form the antireflection film which consists of TiO2, SiN, etc. on the above-mentioned collector 13.
[0034] And the end of the connection tab 2 is superimposed over a length of about 8cm on bus bar section 13B in the collector 13 of the solar battery 1 which carried out in this way and was formed.
[0035] It considered as the configuration equipped with connection 2A covering a length of about 5mm for the configuration, and connection section 2B which rose in height of about 100 micrometers by length of about 1mm using the thing which made solder adhere to both sides of tabular copper foil with a thickness of about 100 micrometers as mentioned above as a connection tab 2. The connection tab 2 of this configuration can be easily formed by letting it pass among one pair of rollers equipped with the height which has a configuration corresponding to the above-mentioned connection section 2B for the tabular conventional connection tab.
[0036] And melting of the solder which adhered on the connection tab 2 was carried out heating the connection tab 2 even in temperature of about 190 degrees C on the above-mentioned bus bar section 13B, and the connection tab 2 was connected on bus bar section 13B.
[0037] Therefore, according to this example, the connection between a solar battery 1 and the connection tab 2 will set a gap with a length of about 1mm, and will be performed in respect of two or more connection which has a length of about 5mm.
[0038] Subsequently, the other end of the connection tab 2 which has the same configuration was superimposed over a length of about 8cm on the rear-face electrode 14 of the solar battery 1 of another side, melting of the solder adhering to the connection tab 2 was carried out, and the connection tab 2 was connected to the rear-face electrode 14.
[0039] And when 20 sets of groups of the solar battery electrically connected by the connection tab 2 as mentioned above were manufactured and the condition was checked visually, there was nothing that failure produced.

[0040] When 20 sets of groups of the solar battery electrically connected by the conventional tabular connection tab on the other hand using the same production process were manufactured and the condition was checked visually, the number of what failure produced was four.
[0041] As mentioned above, according to invention concerning the gestalt of this operation, it becomes possible to offer the solar cell module whose yield improved.
[0042] In addition, in this example, although the connection tab which set the length of about 5mm and the connection section to about 1mm for the length of the connection which forms a connection side with a solar battery was used, the length of a connection and the connection section is not restricted to this. What is necessary is just to let the length of a connection at least be the length of the one half degree of the length which a connection tab and a solar battery superimpose. Moreover, for that, the length of the connection section should just be about 0.5mm or more in length that the effect of the heat stress produced between a solar battery and a connection tab in one connection side among the connection sides formed in the connection which adjoins each other should just be the length of the degree which does not get across even to the connection side of another side.
(Gestalt of the 2nd operation) The manufacture method of the solar cell module built over the 2nd operation gestalt of this invention next is explained.
[0043] Although it is as above-mentioned that failure of the solar battery at the time of connection of a connection tab can be controlled by considering as the configuration where the configuration of a connection tab was indicated in the 1st operation gestalt, if it hits using the substrate which made thickness thin, it is required to also take into consideration the failure at the time of a lamination.
[0044] It aims at setting in the gestalt of this operation and controlling the failure at the time of this lamination, and this operation gestalt is explained with reference to the decomposition cross section shown in drawing 2 . In addition, this drawing (B) is a cross section of the A-A line in (A).
[0045] the above-mentioned -- a passage -- a lamination -- the time -- setting -- a rear face -- a member -- four -- EVA -- from -- becoming -- a sealing agent -- a sheet -- five -- ' -- connection -- a tab -- two -- connecting -- having had -- plurality -- a solar battery -- one -- EVA -- from -- becoming -- a sealing agent -- a sheet -- five -- ' -- and -- the surface -- a member -- three -- a laminating -- carrying out -- having -- becoming -- a layered product -- heating -- compression -- carrying out -- things -- a solar cell module -- ** -- carrying out -- although -- The sheet from which the portion corresponding to the connection tab 2 was removed as above-mentioned sealing agent sheet 5' in the gestalt of this operation is used.
[0046] And although it presses where the layered product which comes to carry out a laminating in this way is heated at about 150 degrees C, and considered as a solar cell module, according to this operation gestalt, a sealing agent sheet does not exist in the portion corresponding to the connection tab 2 in this case. Therefore, direct thrust will not join the portion of the connection tab 2 the first stage at the time of heating compression, and a sealing agent will exude also on the connection tab 2 with softening of a sealing agent sheet, and the closure of the whole solar battery will be carried out with a sealing agent 5, and a solar cell module will be manufactured.
[0047] Therefore, since it can control that direct thrust joins the portion of the connection tab 2 according to the gestalt of this operation, it becomes possible to reduce failure of the solar battery at the time of a lamination.
(Example 2) Subsequently it explains per example of this operation gestalt.
[0048] First, the laminating of sealing agent sheet 5' which consists of EVA with a thickness of about 0.6mm on the rear-face member 4 which consists of an aluminium foil sandwiches mold fluoride [vinyl] film is carried out. Although this sealing agent sheet 5' corresponds to the rear-face side of a solar battery 1, since the thing of about 1mm of **** was used for the connection tab in this example as above-mentioned, this sealing agent sheet 5' is removed over 1.2mm of **** in the field corresponding to the connection tab 2.
[0049] and this sealing agent sheet 5 -- the laminating of 'two or more solar batteries 1 each other electrically connected by the connection tab 2 upwards and the sealing agent sheet 5 from which the field corresponding to the connection tab 2 was removed', and the surface member 3 which consists of glass is carried out. In addition, the connection tab applied to the gestalt of the 1st operation of the above as a connection tab 2 here was used.
[0050] moreover, this example -- setting -- as the surface member 3 -- glass -- moreover, although the aluminium foil sandwiches mold fluoride [vinyl] film was used as a rear-face member 4, it does not matter even if it may use translucency resin, such as PET, an acrylic, and a polycarbonate, not only as this but as a surface member and uses weatherproof materials, such as glass or resin, as a rear-face member.
[0051] furthermore -- such -- a rear face -- a member -- four -- a sealing agent -- a sheet -- five -- ' -- plurality -- a solar battery -- one -- a sealing agent -- a sheet -- five -- ' -- and -- the surface -- a member -- three -- order -- a laminating -- carrying out -- having -- becoming -- a layered product -- drawing 6 -- having been shown -- a lamination -- equipment -- using -- heating compression -- carrying out -- a solar cell module -- having manufactured .
[0052] Thus, when 20 solar cell modules were manufactured and failure of a solar battery 1 was checked visually, there was nothing that was damaged.
[0053] If it was in the solar cell module which, on the other hand, used the connection tab concerning the gestalt 1 of operation for the connection tab, and was manufactured by the conventional method, since the thickness of the substrate 11 of a solar battery 1 was thin, it was easy to damage at the time of a lamination production process, and one thing which has checked failure of the solar battery by viewing while 20 sheets were manufactured existed.

[0054] Furthermore, if it was in the solar cell module which used the conventional tabular connection tab as a connection tab, and was manufactured by the conventional method, failure of a solar battery was checked about seven in the solar cell module manufactured 20 sheets.
[0055] Therefore, according to this operation gestalt, it becomes possible to reduce the thrust which joins the connection tab 2 on a solar battery 1 at the time of heating compression, and it becomes possible to control failure of the solar battery 1 at the time of a lamination.
[0056] In addition, although the sheet from which the portion corresponding to a connection tab was removed as a sealing agent sheet which consists of EVA in this operation gestalt was used, the same effect can be done so even if it uses the sheet with which the portion not only corresponding to this but a connection tab was considered as closing in compared with other portions. Moreover, you may make it arrange two or more sealing agent sheets which became strip of paper-like except for the portion corresponding to a connection tab.
[0057] Furthermore, this invention is applicable also about the solar cell module using the solar battery of other structures of using a crystal system semiconductor as a substrate, for example, the solar battery of the structure which constitutes semiconductor cementation from a crystal substrate and an amorphous semiconductor.
[0058]
[Effect of the Invention] According to the solar cell module by this invention, as explained above, since it connects with a solar battery in two or more connection sides separated mutually, a connection tab can reduce the effect of the heat stress at the time of connection, and becomes possible [controlling failure of a solar battery]. Therefore, the solar cell module whose yield improved can be offered.
[0059] Moreover, since the sealing agent sheet with which the portion corresponding to a connection tab was removed or considered as closing in rather than other portions is used according to the method of a manufacturing method of this invention solar cell module, the thrust to the solar battery at the time of a lamination can be reduced, and failure of a solar battery can be controlled. Therefore, the yield of a solar cell module can be raised.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the cross section having shown the connection condition of the solar battery and connection tab concerning this invention solar cell module.
[Drawing 2] It is a decomposition cross section concerning the manufacture method of this invention solar cell module.
[Drawing 3] It is cross-section structural drawing of the conventional solar cell module.
[Drawing 4] It is structural drawing of the conventional solar battery.
[Drawing 5] It is the state diagram showing the connection condition of the conventional solar battery and a connection tab.
[Drawing 6] It is the block diagram of lamination equipment.
[Description of Notations]
1 [-- A rear-face member, 5 / -- Sealing agent] -- A solar battery, 2 -- A connection tab, 3 -- A surface member, 4
11 [-- The bus bar section, 14 / -- Rear-face electrode] -- A substrate, 12--n layers, 13 -- A collector, 13A -- The finger section, 13B

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